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(56) Documents cited
GB 2166340 A US 4508100 A

(58) Field of search
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INT CL[5] A47J
Online database: WPI

(54) Base for a cooking vessel

(57) A cooking vessel with a flat base of which the outer surface is provided with annular or spiral grooves (6 & 7) coated with two layers. The first layer (9) is in contact with the metal and consists of a material with high radiation heat absorption capacity distributed uniformly over the entire surface of the vessel base. The second layer (10) consists of an enamel or silk-screen process paste which is resistant to abrasion and scratching and is distributed nonuniformly over the surface, preferably in segments and only on the islands between the grooves.

Fig.1

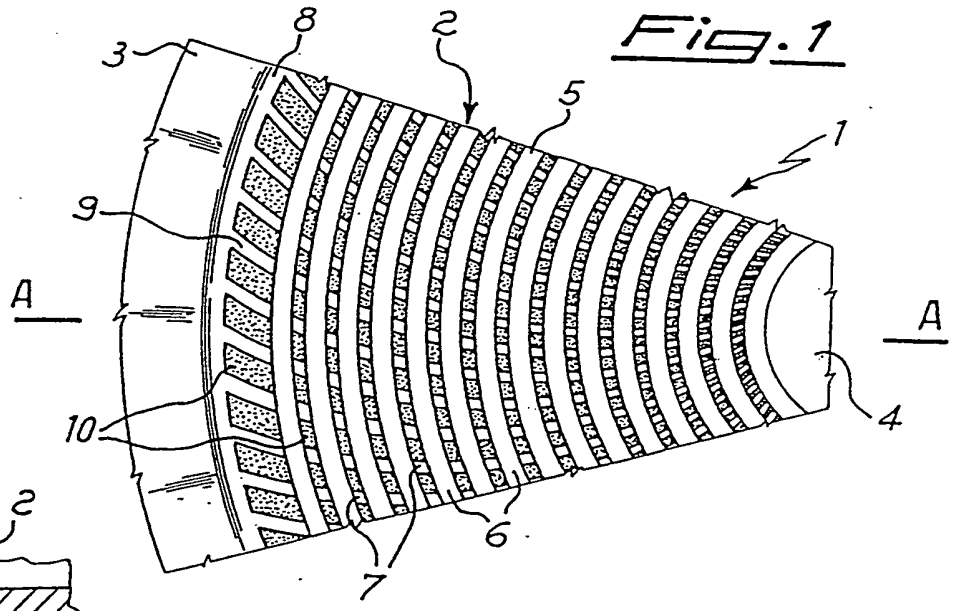

Fig.3

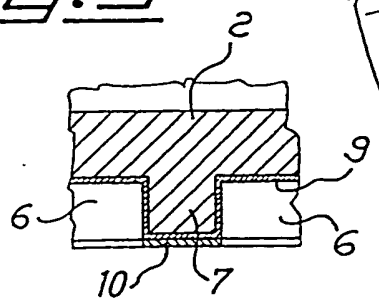

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Fig.1

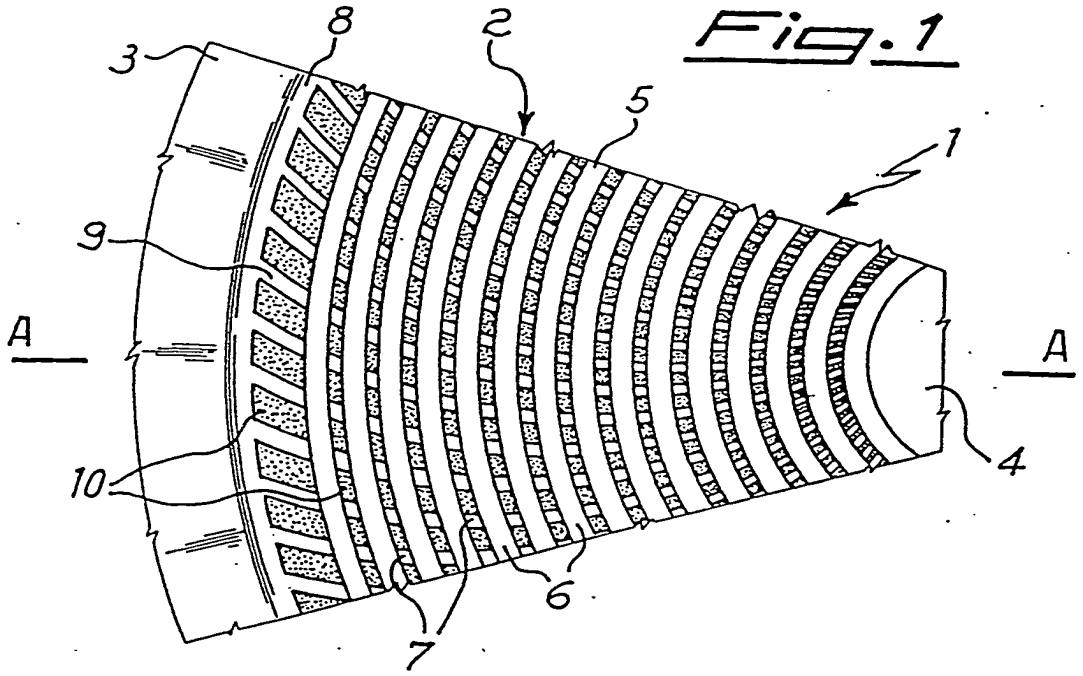


Fig.2

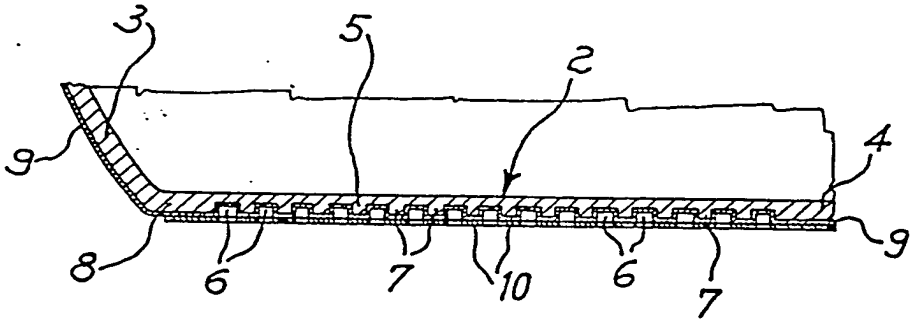


Fig.3

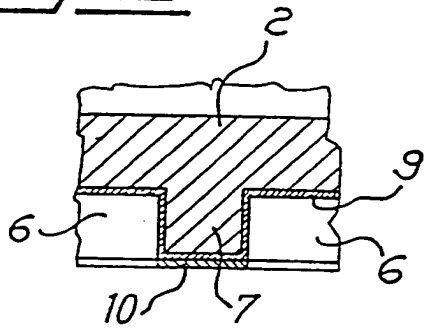


Fig.4

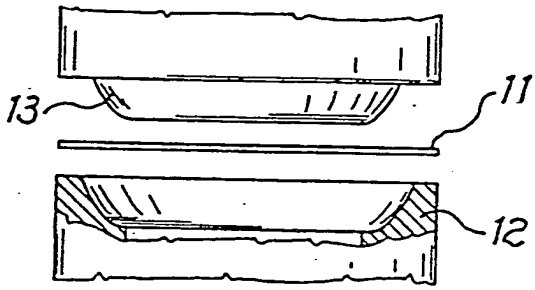
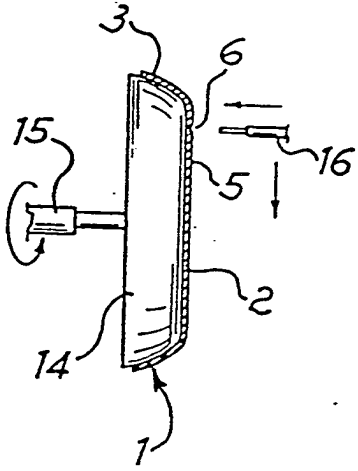


Fig.5



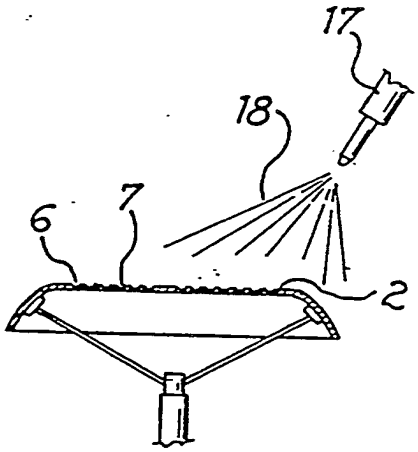
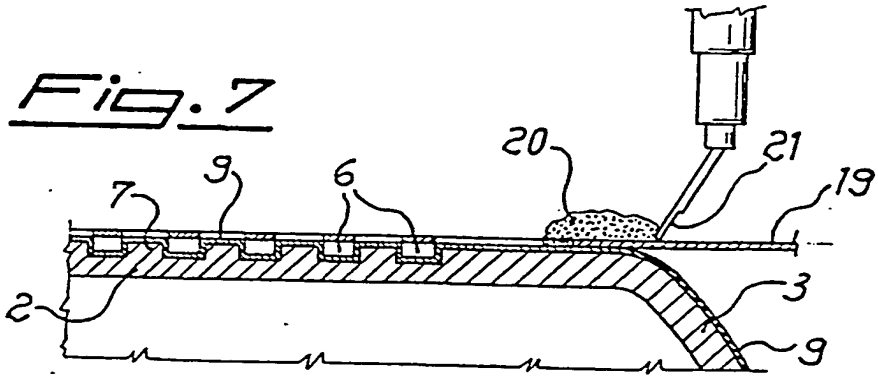


Fig.6

Fig.7



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COOKING VESSELS

The present invention relates to a cooking vessel with a flat bottom, and to a method for producing a cooking vessel with a special bottom.

Cooking vessels, such as saucepans, frying pans, pans, pie pans, pots and the like, are generally made of aluminium or its alloys and have their bottoms as flat as possible to ensure complete contact with heat sources, particularly in the form of heated plates. However, during heating the bottom surface is not heated uniformly. The central zone of the bottom surface is generally at a temperature higher than that of the marginal zone. In addition, the face of the bottom in contact with the heat source is generally hotter than the upper face in contact with the comestibles being heated. These temperature differences lead to differential expansion of the metal, reducing the life of the vessel.

To obviate these shortcomings, it is known from FR-A-1,086.887 to provide the bottom of a cooking vessel with concentric undulations or grooves which permit absorption of the deformations arising from radial forces created by non-uniform thermal movement of different parts of the bottom. One disadvantage of this type of bottom is that it is capable of absorbing from the heat source only thermal energy transmitted by conduction. The heat transmitted by radiation is reflected from the bright surface of the metal of the vessel, thus contributing to heating the vessel. In addition, since there is a tendency to produce vessel bottoms as thin as possible to save material, very often the flat shape of the bottom is deformed after long use of the vessel. This causes a radical drop in contact heat transmission.

To overcome this shortcoming, US-A-4,926,843 describes a process in which a cooking vessel bottom provided with concentric and spaced grooves is coated with a layer of heat-absorbent material only in the grooves, while the material is removed from the bottom in the zones between the grooves, that is from the lands. The heat-absorbing material is generally the same enamel as is used to coat the outer surface of the vessel.

Known enamels used for coating aluminium metal or alloys have the drawback of being soft, that is presenting low resistance to abrasion and scratching. This drawback is because of the composition of the frit of the enamel used, whose curing temperature must be lower than the melting or softening temperature of the aluminium or its alloy.

For this reason, coating with enamels is limited to the side or internal surfaces (grooves) of the vessel, while the surfaces of the bottom in relief remain bare. This limitation of the enamelled surfaces causes incomplete absorption of radiated heat.

The present invention aims at solving these shortcomings.

More particularly, the present invention aims at providing a cooking vessel with a bottom surface of better heat transmission properties and, specifically, higher radiation heat absorption and uniformity of thermal movement.

In accordance with the present invention, these other aims are achieved by a cooking vessel having a bottom whose surface is provided with annular grooves or at least one spiral groove coated with two overlying layers of which the first, which is in contact with the metal, consists of a material having high radiation heat absorption capacity distributed uniformly over the entire bottom surface, and of which the second layer consists of an enamel resistant to abrasion and scratching distributed nonuniformly over the parts of the surface between the grooves.

The cooking vessel is produced by conventional pressing or turning of plates of metal, preferably of aluminium or its alloys. On the flat bottom of the vessel thus obtained the groove or grooves are formed by removal of material by means of a lathe tool. For this purpose the vessel is fixed from the inside on a support and rotated around its central axis in relation to a gouge having straight line movement.

The dimensions of the grooves are not critical for the purposes of the present invention. Generally the depth of each groove is between 0.1mm and 2mm, and its width is between 1mm and 3mm. The lands between the grooves have a width between 1mm and 3mm. The distance between the centre line of the grooves can vary between 4mm and 7mm.

The first layer of coating of the vessel is made with the same enamel generally used for coating the outer surface. The enamel can be of any colour, such as blue, gray, black, etc. Generally dark colours are preferred, with matt or dull surfaces, to ensure better absorption of the radiation heat.

If the enamel which absorbs the heat is fluid, it can be advantageously applied by spraying. Any material having high radiation heat absorption capacity can be used. These materials are well known and can be porcelainized enamels or silicone lakes, preferably with an alkaline silicate or borate base.

The second coating layer is preferably applied by a silk-screen process depositing the silk-screen paste only on the lands and nonuniformly, passing it through a cloth screen with the desired design.

The silk-screen paste can be ceramic-based when the first layer consists of porcelainized enamel, or silicone-based when the first layer consists of silicone lake.

Any colour or silk-screen paste can be employed. Generally a colour contrasting with that of the first coating layer is preferred so as to obtain aesthetic colour effects.

Examples of ceramic-base silk-screen paste which can be used for the bottom coating are those known on the market under the names DA 710015 (which is white), DA 210272 (which is red), DA 110072 (which is black) and DA 710052 (which is transparent) all manufactured and sold by the Bayer Company.

Other colours of silk-screen paste can be obtained by mixing these and other pastes for aluminium or aluminium alloys with colourings or pigments. Thus, for example, a dark gold ceramic-base silk-screen process can be obtained by mixing the base DA 710052 (transparent) containing enamel frit with vitrified gold silicate base, with mica coated with iron oxides, known under the trademark Mearlin Super Bronze.

Any type of silicone-base silk-screen process can be used. An illustrative example can be a modified polyester resin base silk-screen process manufactured and sold by the Tego Gold Schmidt Company under the trademark HTF^{R} containing dispersed mica coated with iron oxides.

The present invention will be better understood from the following detailed description of an example of a preferred embodiment with reference to the annexed drawings wherein :

FIG. 1 shows a partial plan view of the bottom of a pan in accordance with the present invention;
FIG. 2 shows a cross-section of the pan bottom FIG. 1 along the line A-A;
FIG. 3 shows an enlarged cross-section of a land between two grooves of
FIG. 4 shows a schematic illustration of the pan-forming phase;
FIG. 5 shows a schematic illustration of the bottom-grooving phase;
FIG. 6 shows a schematic illustration of the enamel-spraying phase, and
FIG. 7 shows schematically a phase in the silk-screen printing.

With reference to Figures 1-3, the cooking vessel (1), for example an aluminium or aluminium alloy pan, comprises a flat bottom (2) and a side wall (3). The external surface of the bottom (2) of the vessel (1) has three distinct surface parts, as follows :

- a flat central circular area (4) which is preferably concentric with the centre of the vessel (1),
- an annular area (5) provided with a plurality of circular grooves (6) and concentric lands (7), and
- a flat annular peripheral area (8) radiused to the side wall (3).

In accordance with the present invention, the external surface of the bottom (2) is coated with two layers consisting of differenct enamels, of which one layer (9) is of a first enamel having high radiation heat absorption capacity, and the other (10) is of a second enamel having high abrasion resistance.

The first enamel is applied uniformly and in an unbroken manner over the entire bottom surface (2), including the central circular area (4), the bases and walls of the grooves (6), the lands (7), the annular peripheral area (8) and the side wall (3).

The layer (10) of the second enamel is applied only on the lands (7) and on the annular peripheral area (8) and in a broken manner, i.e. in segments, so that the lands (7) and the annular peripheral area (8) have portions not coated with the second enamel.

The parts coated with the second enamel are surfaces on which the vessel (1) rests.

The shape and dimensions of the segments coated with the high abrasion-resistance enamel are not critical for the purposes of the present invention. Generally they are rectangular or square.

With reference to FIGS. 4 to 7, there is now described a preferred method of manufacture of a cooking vessel (1) of the present invention.

First, the cooking vessel (1) is manufactured preferably by pressing an aluminium plate (11) in a press including a die (12) and punch (13) having the form and dimensions of the desired vessel (1). The vessel (1) thus obtained is formed with a flat bottom (2) and a side wall (3). The internal part of the vessel (1) is inserted a template (14) which receives the vessel and blocks it by a compressed air system. The template (14) is connected to a motor (not illustrated) by a shaft (15) so that the template, and hence the vessel, can be rotated around the axis of rotation of the motor.

At the external surface of the bottom (2) of the vessel (1) is the gouge (16) of a lathe having straight-line movements of approach and withdrawal to the bottom (2) and advancement of the peripheral area (8) toward the central area (4). By pressing the gouge (16) against the bottom (2) and rotating the template (14), and by moving the punch (16) in steps towards the central area (4), there are formed a plurality of equidistant concentric circular grooves (6) in the annular area (5) of the bottom (2) by removal of material. As an alternative to annular grooves, the base may have one or more spiral grooves formed in it.

The bottom grooves (6) and lands (7) of the bottom are then sprayed over the entire external surface by a sprayer or nozzle (17) with a material (18) having high radiation heat absorption, such as for example porcelainized enamel or a silicone lake as generally employed for coating aluminium or aluminium alloy vessels. The spraying is done in a uniform and unbroken manner over the entire surface of the bottom (6) and the side wall (3).

The coated vessel (1) is taken under a silk-screen process frame (19) consisting of a cloth screen with impression of a specific design which it is desired to obtain only on the lands (7), on the annular peripheral area (8) and optionally on the central part (4). The silk-screen process paste (20) is fed onto said frame (19) and spread by a rubber spatula (21).

The silk-screen process paste (20) filters through the screen to form a thin layer of the paste on
incremental areas of the lands and outer periphery of the base. The thickness of the layer (10) is of the order of 5-20μm.

The treated vessel is subsequently introduced into an oven with hot air circulation where it is baked at a temperature varying between 300°C and 600°C depending on the silk-screen process lake or enamel used.

The presence of the grooves (6), the coating with one layer (9) of material having high radiation heat absorption capacity, and subsequent coating with a layer (10) of high abrasion resistance material provides excellent heat transmission from the external heat source to the cooking vessel, combined with high abrasion resistance, not common in these types of vessels, and high dimensional stability even after prolonged use. The lands (7) between the grooves (6) act as reinforcement ribs which help hold flat the bottom surface. In addition, both the surface of the lands (7) and that of the grooves (6) absorb all kinds of heat, both contact and radiation, and therefore the contact surface between the vessel and the heat source as well as the quantity of heat transmitted are enormously increased.

To these physical and technical characteristics and advantages are added unquestionable aesthetic advantages because of the colour effect of the combination of colours of the two materials (18,20) used.

Claims:

1 A cooking vessel with a planar base having in it a series of annular grooves or at least one spiral groove with lands between the grooves or turns, at least the base of the vessel being coated with two layers of material, of which the first layer in contact with the base consists of an enamel or lake having high radiation heat absorption capacity, and of which the other layer consists of an enamel having high abrasion resistance, the second layer being applied on incremental areas of the lands.

2 A cooking vessel as claimed in claim 1, in which the external surface of the base comprises three distinct surface areas, to wit:

- a central area;
- an intermediate annular area provided with a groove or grooves and intervening lands, and
- an outer annular area.

3 A cooking vessel as claimed in claim 2, in which the central area, the intermediate annular area, the outer annular area and contiguous outer surfaces of the vessel have coatings thereon of the material of the first layer, and only the lands of the intermediate area and of the outer annular area have coatings thereon of the material of the second layer.

4 A cooking vessel as claimed in any preceding claim, in which the lands are of rectangular cross-section.

5 A cooking vessel as claimed in any preceding claim, in which the second layer is formed from a silk-screen process paste with a ceramic or silicone base.

6 A cooking vessel as claimed in any preceding claim, in which the thickness of the second layer is in the range of from 5 to 20 µm.

7 A cooking vessel as claimed in any preceding claim, having in its base a series of uniformly-spaced annular grooves.

8. A method of manufacturing a cooking vessel as claimed in any preceding claim, comprising the steps of :
- pressing or turning a plate of aluminium or aluminium alloy into a vessel having a planar base with a side wall;
- forming the or each groove in the base by removal of metal with a lathe tool;
- applying over the entire external surface of the base and side wall a thin layer of a first material having high radiation heat absorption capacity;
- applying by a silk-screen process a paste of a second material having high abrasion resistance on incremental areas of the lands on the base;
- baking the vessel in a circulation air oven at a temperature between 300°C and 600°C.

9. Method in accordance with claim 8 in which the grooves are created in an intermediate annular area of the base.

10. Method in accordance with claim 8 or 9, in which the first material is porcelainized enamel, and the second material has a ceramic base.

11. Method in accordance with claim 8 or 9, in which the first material is silicone enamel and the second material has a silicone base.

12. Method in accordance with any of claims 8 to 11 in which the paste is applied on incremental areas of both the lands and the outer periphery of the base.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9305385.8

Relevant Technical fields

(i) UK Cl (Edition L) A4A (ACA, AWA, AWB)

(ii) Int Cl (Edition 5) A47J

Search Examiner
DR D ELSY

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search
1 JULY 1993

Documents considered relevant following a search in respect of claims 1-12

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 2166340 A (O Y ALV) see Figures 1 & 3	1-7
Y	US 4508100 (DEVILLE) see abstract and Figure 1	1-7

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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